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In re patent application of

Koichi Uezono

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For: CIRCUIT BOARD ASSEMBLING STRUCTURE

DECLARATION UNDER 37 CFR 1.55(a)

(Pursuant to 37 CFR 1.68)

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Sir:

I, Kosuke Iijima, declare and state:

that I am a citizen of Japan, having an Office at Tranomon East Building, 7-13, Nishi-Shimbashi 1-chome, Minato-ku, Tokyo 105-8408, JAPAN;

that I well understand the Japanese and English languages;

that the attached English-language document is a full, true and faithful translation made by me of Japanese Application No. 2003-071337 filed on March 17, 2003 on which the right of priority under the International Convention is all claimed for the

above-identified application.

I declare further that all statements made herein of my own knowledge are true that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful statements may jeopardize the validity of the Application or any patent issuing thereon.

Date: August 21, 2006

Kosuke Iijima

PATENT OFFICE

Japanese Government

This is to certify that the annexed is a true copy of the following application as filed with this Office.

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Application Number: 2003 - 071337

Applicant : YAZAKI CORPORATION

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[Title of the Invention] Circuit Board Assembling Structure

[Claims]

[Claim 1] A circuit board assembling structure characterized in that a wiring circuit board on which electric wires are wired is provided with a stepped portion, said stepped portion being continued to a plate portion having a smaller thickness than the wiring circuit board, and that a bus bar circuit board is disposed on said plate portion.

[Claim 2] A circuit board assembling structure as set forth in claim 1, characterized in that said stepped portions are provided on upper and lower faces of said wiring circuit board, said plate portion is positioned in the middle of the wiring circuit board in a direction of thickness, and that said bus bar circuit boards are disposed on upper and lower faces of said plate portion.

[Claim 3] A circuit board assembling structure as set forth in claim 1 or 2, characterized in that said bus bar circuit board is formed to have a thickness equal to or smaller than a thickness of said stepped portion.

[Claim 4] A circuit board assembling structure as set forth in any one of claims 1 to 3, characterized in that bus bars are received in arranging grooves formed on said bus bar circuit board.

[Claim 5] A circuit board assembling structure as set forth in any one of claims 1 to 4, characterized in that terminals of the bus bars of said bus bar circuit board are connected to the electric wires on said wiring circuit board.

[Claim 6] A circuit board assembling structure as set forth in any one of claims 1 to 5, characterized in that a first bus bar circuit board is engaged with one of the stepped portions of said wiring circuit board in a first layer, and a second bus bar circuit board fixed to the wiring circuit board in a second layer is engaged with the other stepped portion of said wiring circuit board.

[Detailed Description of the Invention]

[0001]

[Technical Field to which the Invention Belongs]

The present invention relates to a circuit board assembling structure which is applied to an electric junction box or the like, and adapted to assemble a wiring circuit board on which electric wires are wired and a bus bar circuit board on which bus bars are arranged thereby to constitute a circuit board assembly.

[0002]

[Prior Art]

Fig. 3 shows one example of a conventional circuit board assembling structure for an electric junction box (refer to Patent Document 1).

[0003]

This electric junction box 51 includes a plurality of bus bar circuit boards 52 to be stacked one on another, and a wiring circuit board 53 disposed below the bus bar circuit boards 52. The bus bar circuit boards 52 and the wiring circuit board 53 constitute a circuit board assembly, and upper and lower covers 54 and 55 made of synthetic resin contain the circuit board assembly.

[0004]

Each of the bus bar circuit boards 52 includes a plurality of bus bars 56 made of conductive sheet metal in desired shapes, and an insulative substrate 57 on which the bus bars 56 are arranged. The bus bars 56 are provided with tab terminals 58 which are continuously extended from their end portions or intermediate portions. The terminals 58 are received in connector housings 59 of the upper cover 54 thereby to constitute a connector, or connected to fuses and relays in the upper cover by way of relay terminals 60 of a female type.

[0005]

The wiring circuit board 53 includes a plurality of electric wires 61, and a case 62 made of insulative resin on which the electric wires 61 in desired shapes are arranged. Each of the electric wires 61 is press-fitted to one contact portion 63a of a terminal 63 at a desired position inside the case. The other contact portion 63b of the terminal 63 is passed

through a hole 64 of the case 62 to be connected to a terminal of the bus bar 56, or passed through the lower cover 55 to be received in connector housings below the lower cover 55.

[0006]

The bus bars 56 are mainly suitable for a large current circuit such as a power source circuit, and the electric wires 61 are mainly suitable for a small or middle current circuit such as a signal circuit. The bus bars 56 and the electric wires 61 are connected to each other so that an electric power can be supplied to the connector of the lower cover 55. Exterior wire harnesses (not shown) continued to the power source and an auxiliary equipment are connected to the connectors of the upper and lower covers 54, 55.

[0007]

[Patent Document 1]

Japanese Patent Publication No. JP-A-9-140028

(Page 3, Fig. 2)

[0008]

[Problems that the Invention is to Solve]

However, in the above described configuration, since the bus bar circuit boards 52 and the wiring circuit board 53 are stacked in a direction of their thickness, the more specifications of the circuits becomes complicated, the more the circuit board assembly become upsized in a vertical direction, so that the electric junction box 51 accordingly become

large-sized. Further, since the bus bar circuit boards 52 has to be assembled to the wiring circuit board 53 after the wiring board 53 is assembled to the lower cover 55, a lot of working steps are required in assembling the circuit board assembly, that is, the electric junction box 51.

[0009]

In view of the above described problems, it is an object of the invention to provide a circuit board assembling structure in which a circuit board assembly can prevented from being upsized in a stacking direction thereby to obtain a compact electric junction box, and the circuit board assembly (an electric junction box) can be easily assembled with decreased working steps.

[0010]

[Means for Solving the Problems]

In order to attain the above described object, a circuit board assembling structure according to claim 1 of the invention is characterized in that a wiring circuit board on which electric wires are wired is provided with a stepped portion, the stepped portion being continued to a plate portion having a smaller thickness than the wiring circuit board, and that a bus bar circuit board is disposed on the plate portion.

According to the above described structure, the bus bar circuit board having the bus bars is arranged along the plate portion of the wiring circuit board, and thus, the bus bar circuit

board and the wiring circuit board become integral with each other. The bus bar circuit board is sunk by a depth dimension of the stepped portion, and the assembling structure can be made compact and light weight in a direction of thickness of the circuit boards. A circuit board assembly can be formed by assembling the bus bar circuit board in advance in the stepped portion of the wiring circuit board to be integral with the wiring circuit board, and the circuit board assembly is received in a cover of an electric junction box, thus enabling the electric junction box to be assembled easily with decreased working steps.

[0011]

A circuit board assembling structure according to claim 2 is, in the circuit board assembling structure as set forth in claim 1, characterized in that the stepped portions are provided on upper and lower faces of the wiring circuit board, the plate portion is positioned in the middle of the wiring circuit board in a direction of thickness, and that the bus bar circuit boards are disposed on upper and lower faces of the plate portion.

According to the above described structure, the circuit board assembly is composed of two sheets of the upper and lower bus bar circuit boards and one sheet of the wiring circuit board. The two sheets of the bus bar circuit boards are assembled to the common wiring circuit board at symmetrical upper and lower positions in a state sunk by the depth dimension of the stepped

portions. The circuit board assembly can be made applicable to many connecting circuits by way of the two sheets of the bus bar circuit boards. Because the thin-walled plate portion is positioned in the middle of the wiring circuit board in the direction of thickness, the circuit board assembly becomes well balanced, and can be efficiently applied to the connecting circuits in the upper and lower. For example, after one of the bus bar circuit boards is assembled to one of the stepped portions of the wiring circuit board to be integral therewith, at the same time when the wiring circuit board is stacked on the other wiring circuit board, the other bus bar circuit board on the other wiring circuit board can be engaged with the other stepped portion. In this manner, the circuit board assembly, that is, the electric junction box can be easily and efficiently assembled with decreased working steps. It is also possible to connect two sheets of the bus bar circuit boards to one sheet of the wiring circuit board.

[0012]

A circuit board assembling structure according to claim 3 is, in the circuit board assembling structure as set forth in claim 1 or 2, characterized in that the bus bar circuit board is formed to have a thickness equal to or smaller than a thickness of the stepped portion.

According to the above described structure, not only the circuit board assembly can be made compact in the direction

of thickness, but other components such as other circuit boards, covers, electronic control units can be disposed on a same plane without a clearance or with a slight clearance, across the bus bar circuit board and the wiring circuit board. Moreover, since the circuit board assembly has no protuberance both on the upper and lower faces, the circuit board assembly can be smoothly mounted into the cover of the electric junction box, thus enhancing assembling workability.

[0013]

A circuit board assembling structure according to claim 4 is, in the circuit board assembling structure as set forth in any one of claims 1 to 3, characterized in that bus bars are received in arranging grooves formed on the bus bar circuit board.

According to the above described structure, the bus bars can be positioned and arranged easily and accurately, and at the same time, the thickness of the bus bar circuit board including the bus bars can be reduced. Moreover, the bus bars are insulated from one another in the arranging grooves, and insulating boards separately provided on occasion of stacking is not necessary.

[0014]

A circuit board assembling structure according to claim 5 is, in the circuit board assembling structure as set forth in any one of claims 1 to 4, characterized in that terminals

of the bus bars of the bus bar circuit board are connected to the electric wires on the wiring circuit board.

According to the above described structure, the bus bar circuit board and the wiring circuit board are connected to each other, and the circuit board assembly which is integral in both electrical and structural aspects can be formed. For example, by employing the terminals of the bus bars as pressure fitted terminals, connection between the electric wires and the terminals, that is, interconnection between the circuit boards becomes easy and efficient. Large electric current such as a power source is energized by way of the bus bars, and small or middle electric current such as a signal will be energized by way of the electric wires. Moreover, because the bus bar circuit boards are respectively connected and fixed to the wiring circuit boards, at the same time when both the wiring circuit boards is stacked, one of the bus bar circuit boards is engaged in the stepped portion of the other wiring circuit board. In this manner, assembling of the circuit board assembly can be conducted efficiently. It goes without saying that the wiring circuit boards and the bus bar circuit boards are integrated into one, and assembling of the electric junction box is easily and efficiently conducted.

[0015]

A circuit board assembling structure according to claim 6 is, the circuit board assembling structure as set forth in

any one of claims 1 to 5, characterized in that a first bus bar circuit board is engaged with one of the stepped portions of the wiring circuit board in a first layer, and a second bus bar circuit board fixed to the wiring circuit board in a second layer is engaged with the other stepped portion of the wiring circuit board.

According to the above described structure, at the same time when the two wiring circuit boards are stacked, the bus bar circuit board on the wiring circuit board in the second layer is engaged with one of the stepped portions of the wiring circuit board in the first layer. The bus bar circuit board has been engaged in advance in the other stepped portion of the wiring circuit board in the first layer, and at the same time when both the wiring circuit boards are stacked, the two sheets of the bus bar circuit boards is arranged in parallel in a direction of thickness. By arranging one sheet of the bus bar circuit board on each one sheet of the wiring circuit board in advance, a work for electrical connection between the wiring circuit board and the bus bar circuit board by pressure fitting or welding can be simplified. After the connection is finished, both the wiring circuit boards is stacked.

[0016]

[Mode for Carrying Out the Invention]

Now, an embodiment of the invention will be described in detail referring to the drawings.

Figs. 1 and 2 show one embodiment of a circuit board assembling structure according to the invention.

[0017]

This circuit board assembling structure includes a plurality of (two sheets in this embodiment) wiring circuit boards 1, 2, two sheets of bus bar circuit boards 5, 6 disposed in stepped portions 3, 4 which are respectively formed on an upper face and a lower face of the wiring circuit board 1 in the lower layer, and a plurality of (two sheets) bus bar circuit boards 8 which are stacked on the wiring circuit board 2 in the upper layer by way of a base board 7. This circuit board assembling structure is particularly characterized in that the two sheets of the bus bar circuit boards 5, 6 are disposed within a range of thickness of the wiring circuit board 1 in the lower layer.

[0018]

The wiring circuit board 1 in the lower layer has the stepped portions 3, 4 on both upper and lower faces in a forward half area, as shown in Fig. 2 (as seen from the bottom), thereby to form a thinned part 9 at the middle in a direction of thickness of the wiring circuit board 1. The bus bar circuit boards 5, 6 are disposed on both upper and lower faces of the thinned part 9 (Fig. 1). A thickness of the bus bar circuit boards 5, 6 which have the same thickness is equal to or smaller than a depth of the step, and the total thickness of the thin-walled

part 9 and the bus bar circuit boards 5, 6 is equal to or smaller than a thickness of other part 10 (see Fig. 2) in a rear half of the wiring circuit board 1. Respective outer faces of the bus bar circuit board 5, 6 are positioned on the same planes or on lower planes than both the front and back faces (without protruding from the upper and lower faces) of the wiring circuit board 1 (Fig. 1).

[0019]

Therefore, the wiring circuit board 2 in the upper layer is stacked on the wiring circuit board 1 in the lower layer without clearance, and components such as a lower cover, an electronic control unit, etc. (not shown) can be arranged below the wiring circuit board 1 in the lower layer without clearance, or with a slight clearance. Therefore, the space saving can be attained.

[0020]

As shown in Fig. 1, each of the wiring circuit boards 1, 2 in the respective layers includes a case 11 made of insulating resin, and a plurality of electric wires 12 which are arranged in desired shapes and connected at pressure fitted portions 14 of terminals 13. The case 11 is formed in a flat shape having at least a vertical peripheral wall 16 in a frame-like shape and a horizontal bottom wall 17. The case 11 in the lower layer has the thin-walled plate portion 9 which is continued horizontally from a front part (not shown) of the peripheral

wall 16. Both the upper and lower faces of the thin-walled plate portion 9 are preferably reinforced with grid-like ribs (not shown) and are made light weight.

[0021]

The terminals 13 of the wiring circuit boards 1, 2, to which the electric wires 12 are press-fitted, are fixed inside frame-shaped retaining walls 18 in the case 11. Tab-shaped or pin-shaped contact portions 15, 19 of the terminals 13 project to an opposite side to the press-fitting portions 14. For example, the tab electric contact portions 15 are received in connector housings of a main cover (not shown) located on the wiring circuit board 2 in the upper layer, and the pin-shaped contact portions 19 are passed through the wiring circuit board 1 in the lower layer to be connected to the electronic control unit (not shown). A manner of arranging the electric wires 12 and positioning the terminals 13 on the wiring circuit boards 1, 2 in the upper and lower layers can be appropriately determined according to the specification of the circuits.

[0022]

As shown in Fig. 2, each of the upper and lower bus bar circuit boards 5, 6 includes an insulative substrate 20 made of synthetic resin, and bus bars 21 made of conductive metal in various shapes and arranged on the insulative substrate 20. The insulative substrate 20 is formed with arranging grooves 22 having a same depth as a thickness of the bus bars 21. The

bus bars 21 are positioned and received in the arranging grooves 22, and insulated from one another by partitions (represented also by numeral 20) between the arranging grooves 22. The bus bars 21 have tuning-fork shaped terminals (clamping terminals) 24 for connecting fuses, press-fitting terminals 25 for connecting the electric wires, and tab terminals 26 adapted to be contained in the connector housings, relay mounting parts and so on of the cover (not shown).

[0023]

The tuning-fork shaped terminals 24 are horizontally projected from front edges of the wiring circuit boards 1, 2, and received in a fuse block 27 as shown in Fig. 1. As shown in Fig. 2, the tuning-fork shaped terminals 24 are vertically bent along the front end face of the wiring circuit board 1 from the bus bar circuit board 5 in the lower layer, and horizontally projected in a forward direction. The tuning-fork shaped terminals 24, which are projected from the bus bar circuit board 6 in the upper layer, are aligned on a same plane as a lower face of the insulative substrate 20, that is, aligned with the tuning-fork shaped terminals 24 of the bus bar circuit board 5 in the lower layer.

[0024]

The press-fitting terminals 25 of the bus bars 21 are extended toward the electric wires 12 of the wiring circuit boards 1, 2, as shown in Fig. 2, and press-fitted to the electric

wires 12 provide inside the retaining walls 18 of the cases 11. Press-fitting of the electric wires 12 is conducted in a state the bus bar circuit board 5 in the lower layer is mounted on a bottom face of the wiring circuit board 1 in the lower layer (an upper side in Fig. 2), as shown in Fig. 2. The bus bar circuit board 6 in the upper layer is mounted on a bottom face of the wiring circuit board 2 in the upper layer. Pressure fitting of the electric wires 12 is conducted in this state. After the electric wires 12 in the respective layers are press-fitted, the wiring circuit boards 1, 2 in both the layers are stacked (assembled) on each other, while the bus bar circuit board 6 in the upper layer is received in the stepped portion (dented part) 4 at an upper side of the wiring circuit board 1 in the lower layer. The bus bar circuit boards 5, 6 are respectively fixed to the wiring circuit boards 1, 2, by press fitting the electric wires 12 to the press-fitting terminals 25.

[0025]

As shown in Fig. 2, positions and shapes of boundaries 28 between the bus bar circuit boards 5, 6 and the wiring circuit boards 1, 2 are appropriately set, according to pressure fitting positions of the electric wires 12 to the bus bars 21, layouts of the bus bars 21 and so on. The wiring circuit board 1 in the lower layer has short support posts 29 which serve to support the electronic control unit (not shown) and to fix the unit thereon with screws. The bus bar circuit boards 5, 6 have holes

30 allowing the support posts 19 to pass through. The holes 30 and the support posts 29 serve also as members for positioning the bus bar circuit boards 5, 6 with respect to the wiring circuit boards 1, 2.

[0026]

In this embodiment, a plurality of (two sheets) of the bus bar circuit boards 8 are also provided on the upper face of the wiring circuit board 2 in the upper layer by way of the base plate 7, as shown in Fig. 1. Electronic components (not shown), for example, are disposed in an inner space of the base plate 7, and connected to the electric wires 12 and so on. It is also possible to provide the bus bar circuit boards 8 directly on the upper face of the wiring circuit board 2 in the upper layer, while omitting the base plate 7 and the electronic components.

[0027]

This bus bar circuit board 8 has tuning-fork shaped terminals 31 continued from bus bars 32 in the same manner as described above. The tuning-fork shaped terminals 31 are arranged in two upper and lower steps. In correspondence with the tuning-fork shaped terminals 24 of the upper and lower bus bar circuit boards 5, 6 laterally arranged in a row, a bus bar 34 having tuning-fork shaped terminals 33 laterally arranged in a row has been disposed in advance in the fuse block 27 (Fig. 1). The tuning-fork shaped terminals 24, 31, 33 in four rows

are composed of the bus bars 21, 32, 34. Fuses 36 are contained in containing chambers 35 in two upper and lower steps in the fuse block 27, and a pair of upper and lower tab terminals 37 of the fuses 36 are clamped for connection by the tuning-fork shaped terminals 24, 31, 33 in the respective steps.

[0028]

The fuse block 27 is joined to a circuit board assembly 37 which includes the wiring circuit boards 1, 2 and the bus bar circuit boards 5, 6, 8, in a direction of an arrow. At the same time, a side terminal 38 of the bus bar 34 in the fuse block 27 comes into contact with a side terminal 39 of the bus bar 32 of the bus bar circuit board 8. Both the terminals 38, 39 are connected by welding or by other means.

[0029]

A sub assembly 40 which is composed of the circuit board assembly 37 and the fuse block 27 is covered for protection with the main cover and the lower cover (not shown), and the electronic control unit (not shown) is mounted outside the lower cover, thereby to constitute the electric junction box. The bus bars 21 (Fig. 2) of the bus bar circuit board 5, 6 are connected to the fuses 36 by way of the tuning-fork shaped terminals 24, to the relays and the connectors of the exterior wire harnesses by way of the tab terminals 26, and to the connectors (not shown) of the exterior wire harnesses and the electronic control unit (not shown) by way of the press-fitting terminals 25, the

electric wires 12 and the terminals 15, 19 (Fig. 1).

[0030]

In the above described embodiment, it is possible to omit the wiring circuit board 2 in the upper layer and the bus bar circuit board 8 mounted thereon, and to connect the fuses 36 laterally arranged in a row (one step) for example, by means of the wiring circuit board 1 in the lower layer and one or two sheets of the bus bar circuit boards 5, 6 above and below. It is also possible to connect two sheets of the bus bar circuit boards 5, 6 to one sheet (in the lower layer) of the wiring circuit board 1. It is also possible to form one stepped portion 3 (or 4) above or below the wiring circuit board 1. Moreover, positions, numbers, etc. of the tab terminals 26, the tuning-fork shaped terminals 24, and the pressure fitted terminals 25 of the bus bar circuit boards 5, 6, and positions, numbers, etc. of the terminals 13 of the wiring circuit boards 1, 2 can be appropriately determined according to the specifications of the circuits. Further, it is possible to form terminals to be connected to the electric wires 12 by soldering, welding or pressure fitting and so on, in place of the pressure fitted terminals 25 of the bus bars 21.

[0031]

It is also possible to omit the electronic control unit in constituting the electric junction box. It is also possible to form terminals for connecting relays or terminals for

connecting connectors, in place of the tuning-fork shaped terminals 24 for connecting the fuses. Further, directivity of the upper layer and the lower layer can be appropriately changed according to a manner of installing the electric junction box. Further, the circuit board assembling structure according to the invention can be applied as the circuit board assembly for various appliances, a control panel, etc., besides the electric junction box.

[0032]

[Advantages of the Invention]

As has been described above, according to the invention as set forth in claim 1, because the bus bar circuit board is sunk by a depth dimension of the stepped portion, and the assembling structure is made compact in a direction of thickness of the circuit board, the electric junction box can be made small-sized and light weight. Moreover, by assembling the bus bar circuit board in the stepped portion of the wiring circuit board to be integral with the wiring circuit board, the electric junction box can be assembled efficiently with decreased working steps.

[0033]

According to the invention as set forth in claim 2, even though the two sheets of the bus bar circuit board are employed, the circuit board assembly can be formed in a flat shape, and the electric junction box can be further made small-sized and

light weight. Moreover, after one of the bus bar circuit boards, for example, has been assembled to one of the stepped portions of the wiring circuit board to be integral therewith, the other bus bar circuit board of the other wiring circuit board can be engaged with the other stepped portion, while the wiring circuit board is stacked on the other wiring circuit board. In this manner, the circuit board assembly, that is, the electric junction box can be easily and efficiently assembled with decreased working steps.

[0034]

According to the invention as set forth in claim 3, not only the circuit board assembly can be made compact in the direction of thickness, but other components such as other circuit boards, covers, electronic control units can be disposed across the bus bar circuit board and the wiring circuit board with space saving and high workability. In this manner, assembling of the electric junction box can be more efficiently conducted with high workability.

[0035]

According to the invention as set forth in claim 4, projection of the bus bars from the bus bar circuit board will be eliminated, and the thickness of the circuit board assembly can be further reduced.

According to the invention as claimed in claim 5, the bus bar circuit board and the wiring circuit board will be

interconnected to be integral with each other in both electrical and structural aspect, and electrical connection and assembling of the electrical junction box will be efficiently conducted.

[0036]

According to the invention as set forth in claim 6, by arranging each one sheet of the bus bar circuit board on each one sheet of the wiring circuit board in advance, a work for electrical connection between the wiring circuit board and the bus bar circuit board can be easily and efficiently conducted, and assembling performance of the electric junction box will be further improved.

[Brief Description of the Drawings]

Fig. 1 is an exploded perspective view showing an embodiment of a circuit board assembling structure (a sub assembly) in an electric junction box according to the invention.

Fig. 2 is an exploded perspective view showing the circuit board assembling structure (a circuit board assembly).

Fig. 3 is an exploded perspective view showing an example of a conventional circuit board assembling structure.

[Description of Reference Numerals and Signs]

1 wiring circuit board

2 wiring circuit board in an upper layer (second layer)

3, 4 stepped portion

5, 6 bus bar circuit board

9 plate portion

12 electric wire

21 bus bar

22 arranging groove

25 terminal (pressure fitted terminal)

37 circuit board assembly

[Designation of Document] Abstract

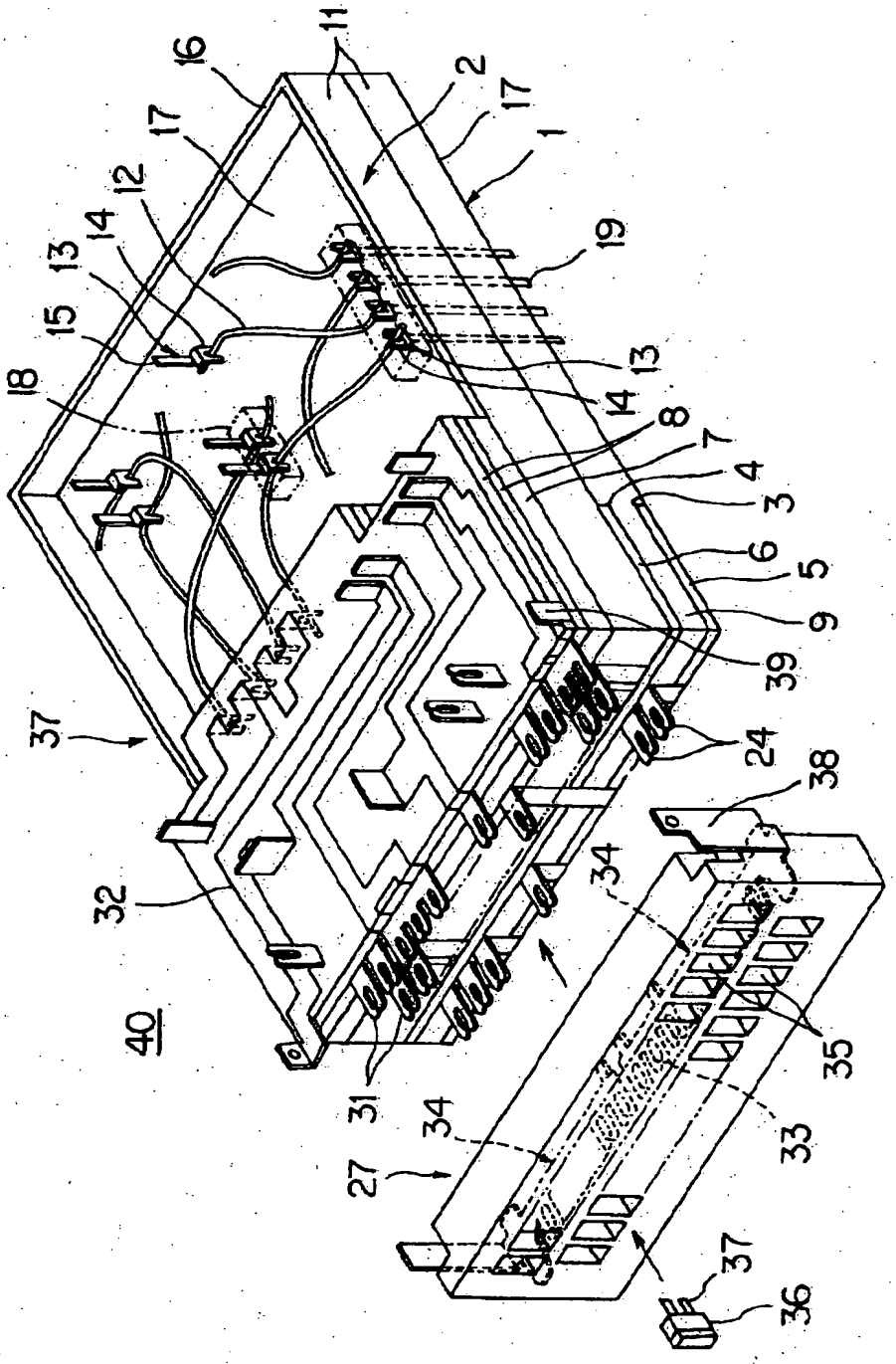
[Abstract]

[Problems] To reduce thickness of a circuit board assembly including bus bar circuit boards.

[Means for Solution] A wiring circuit board 1 on which electric wires 12 are arranged is provided with stepped portions 3, 4, the stepped portions being continued to a plate portion 9 having a smaller thickness than the wiring circuit board, and bus bar circuit boards 5, 6 are disposed on the plate portion 9. The stepped portions 3, 4 are provided on upper and lower faces of the wiring circuit board 1, the plate portion 9 is positioned in the middle of the wiring circuit board in a direction of thickness, and the bus bar circuit boards 5, 6 are disposed on upper and lower faces of the plate portion. The bus bar circuit boards 5, 6 are formed to have a thickness equal to or smaller than a thickness of the stepped portions 3, 4. Bus bars 21 are received in arranging grooves 22 formed on the bus bar circuit boards 5. 6. Terminals 25 of the bus bars 21 of the bus bar circuit board 5 are connected to the electric wires 12 on the wiring circuit board 1. A first bus bar circuit board 5 is engaged with one of the stepped portions 3 of the wiring circuit board 1 in a first layer, and a second bus bar circuit board 6 fixed to the wiring circuit board 2 in a second layer is engaged with the other stepped portion 4 of the wiring circuit board 1.

[Selected Drawing] Fig. 2

【書類名】 図面
Designation of Document Drawing
【図1】
Fig. 1



1 ... wiring circuit board
2 ... wiring circuit board in upper layer (second layer)
3, 4 ... stepped portion
5, 6 ... bus bar circuit board
9 ... plate portion

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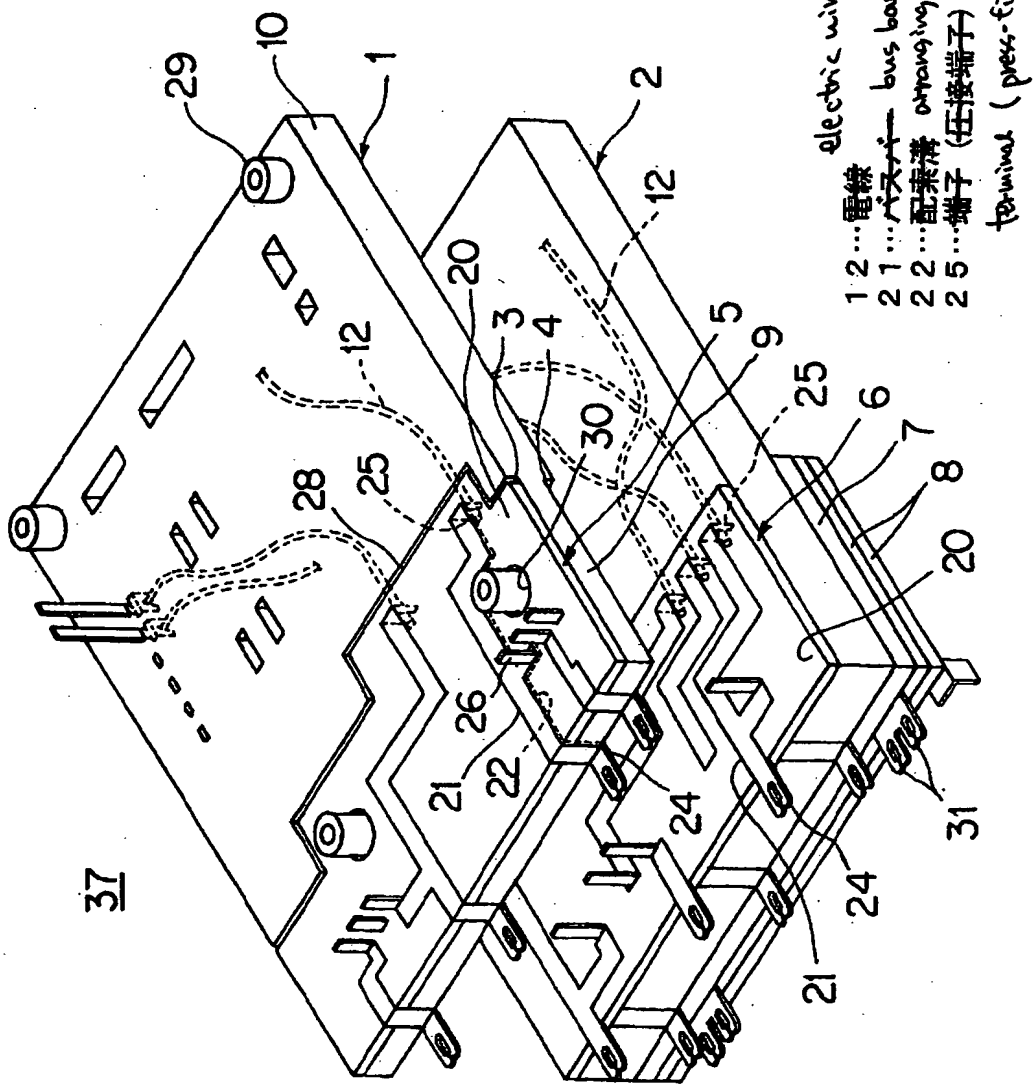
【図2】
Fig.2



【図3】
Fig.3